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(54) **Improvements relating to heating systems**

(57) A room heating unit comprises a casing 1 fixed against a wall 3 and resting on the floor of the room. Within the casing 1 is an aluminium block heater 9 incorporating a spirally wound resistance heating element 11. When power is supplied to the heater 9 warm air is fed into the room through a grille 8 and cool air is drawn into the casing (for heating) through a lower grille 7.

Several heaters 9 are independently connected to a microprocessor control unit which switches the heating units on in a predetermined sequence so that the instantaneous power consumption is low and the units can be supplied at low voltage.

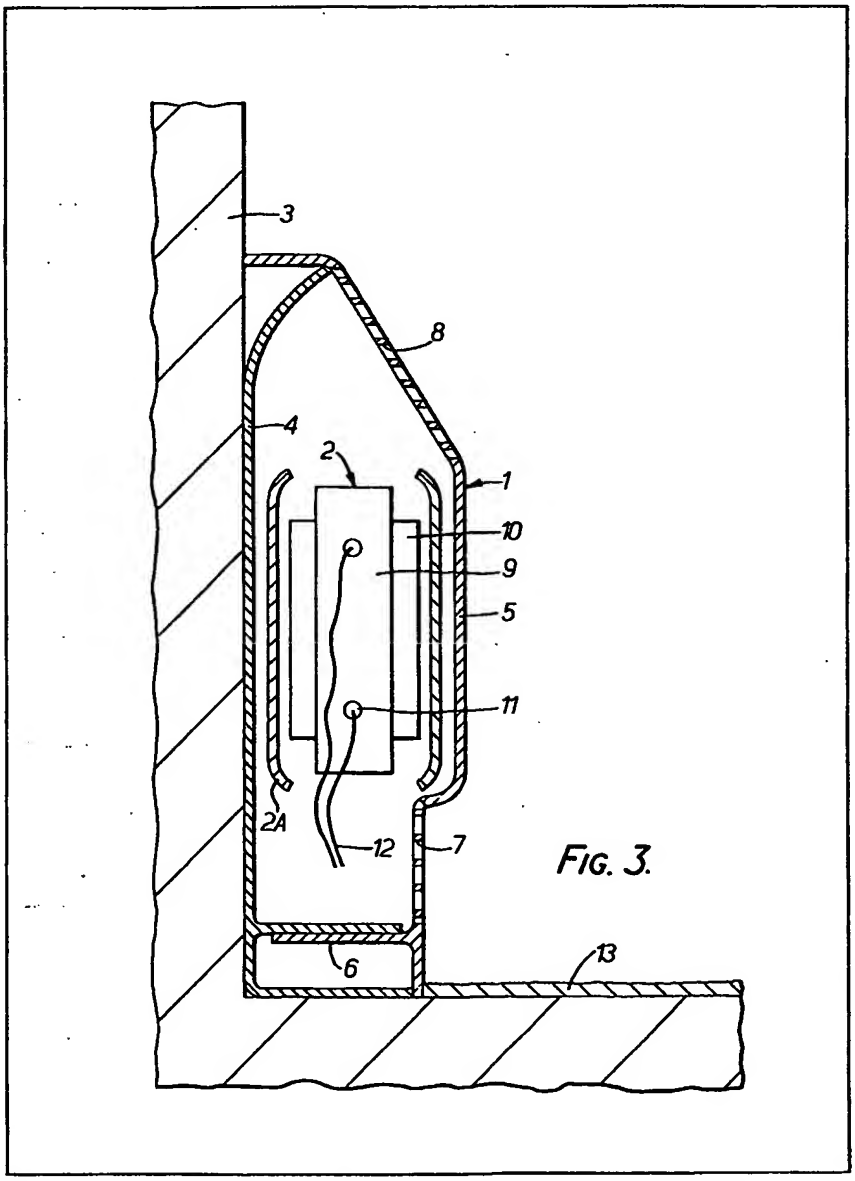

FIG. 3.

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The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.

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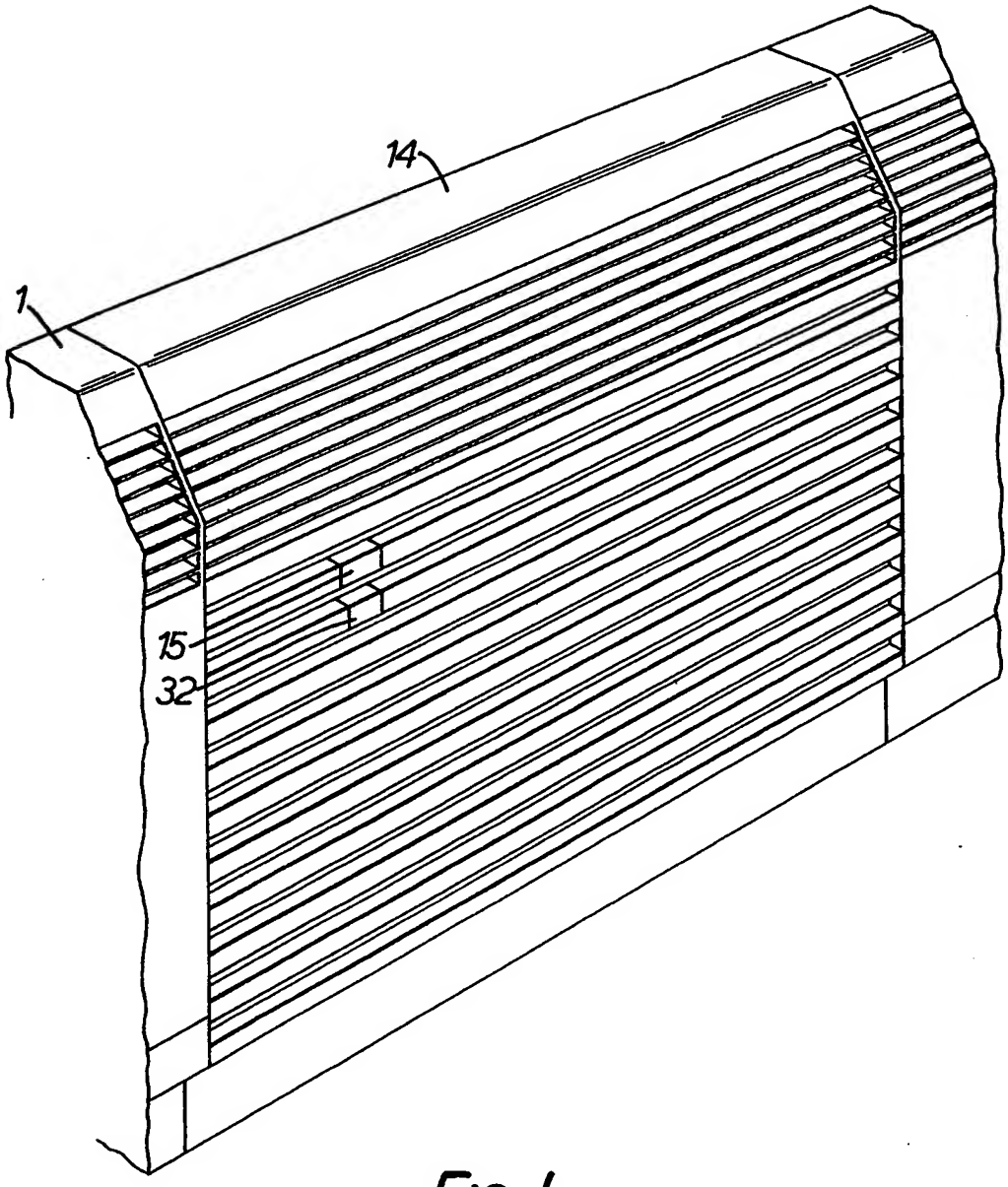

FIG. 1.

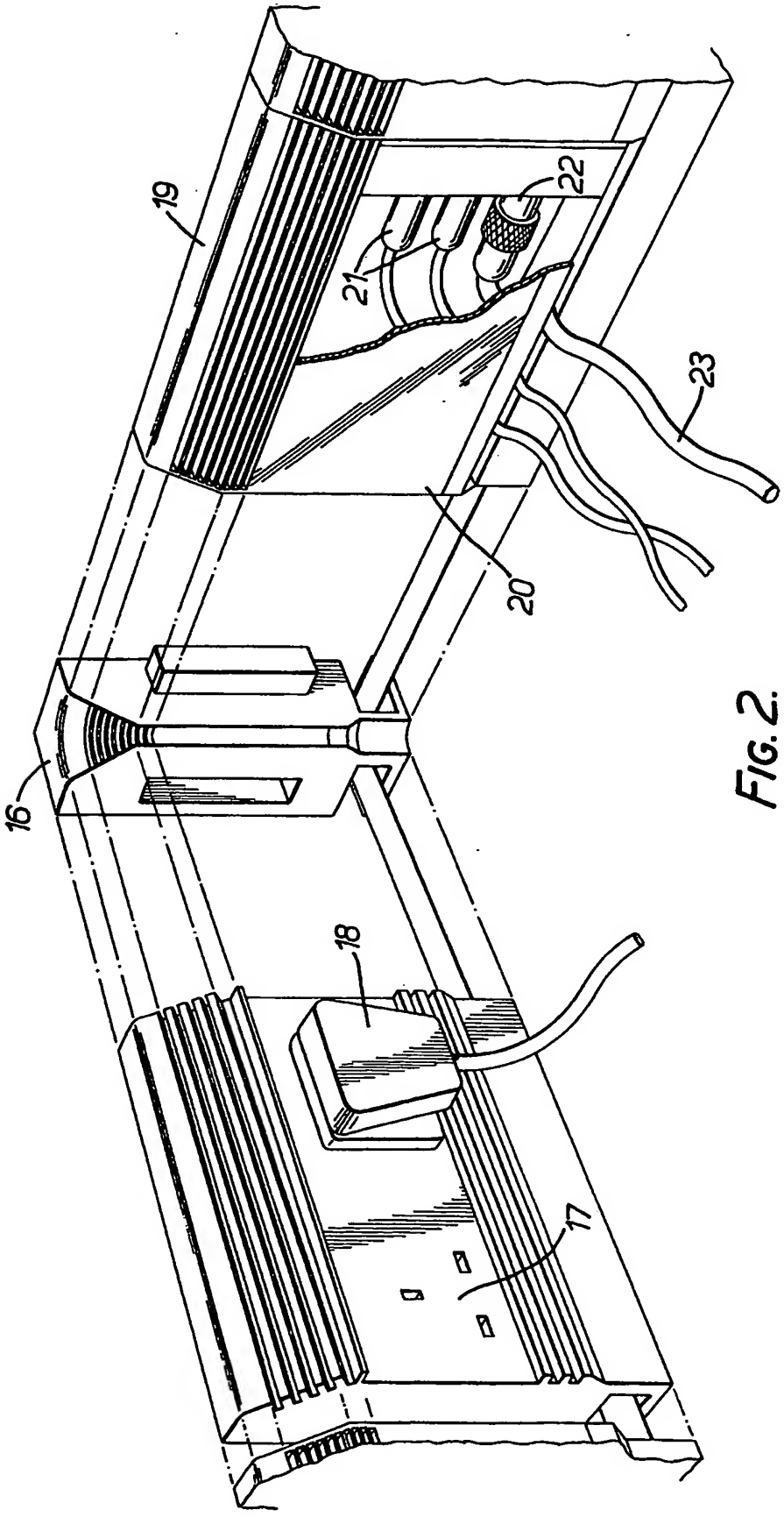

FIG. 2.

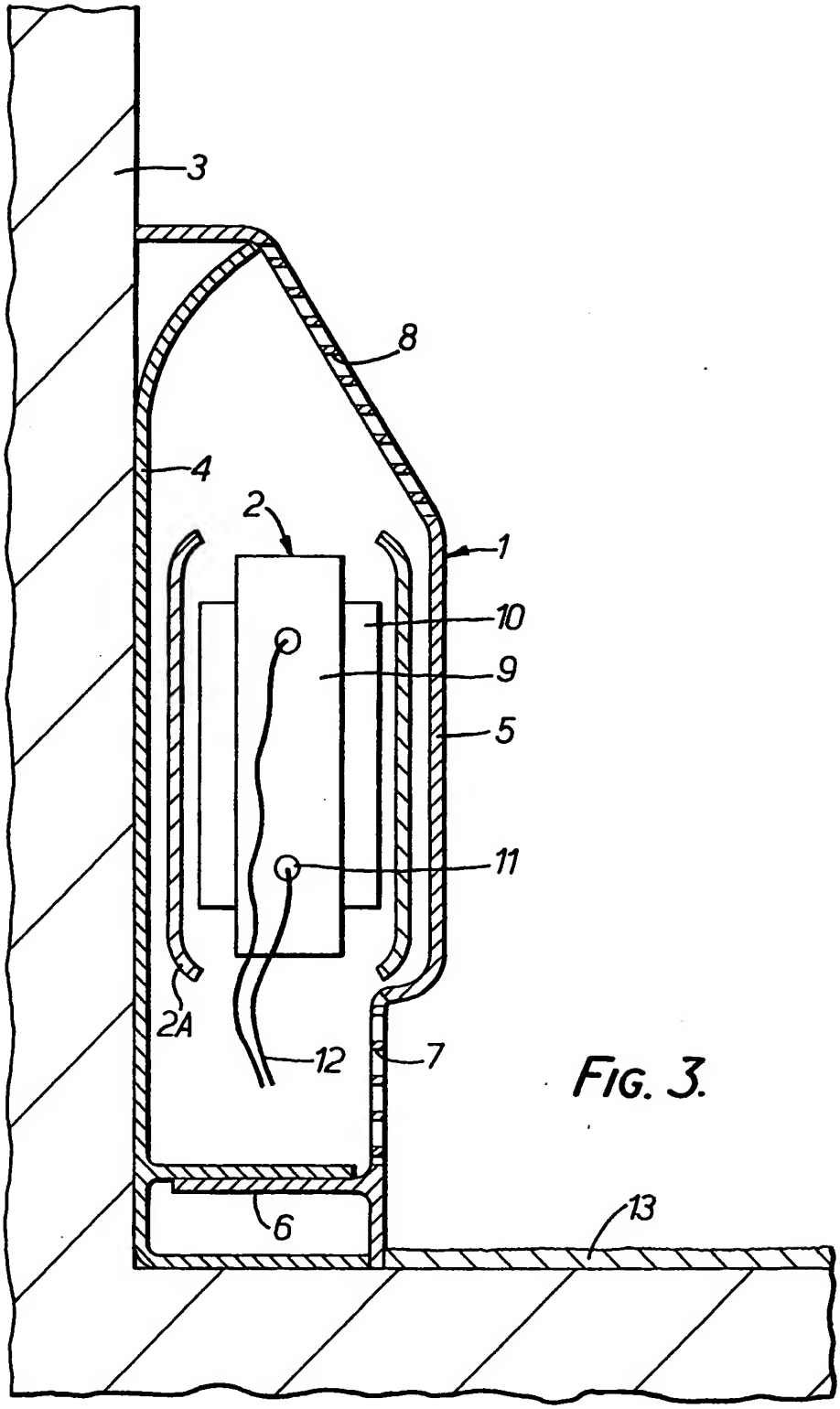

FIG. 3.

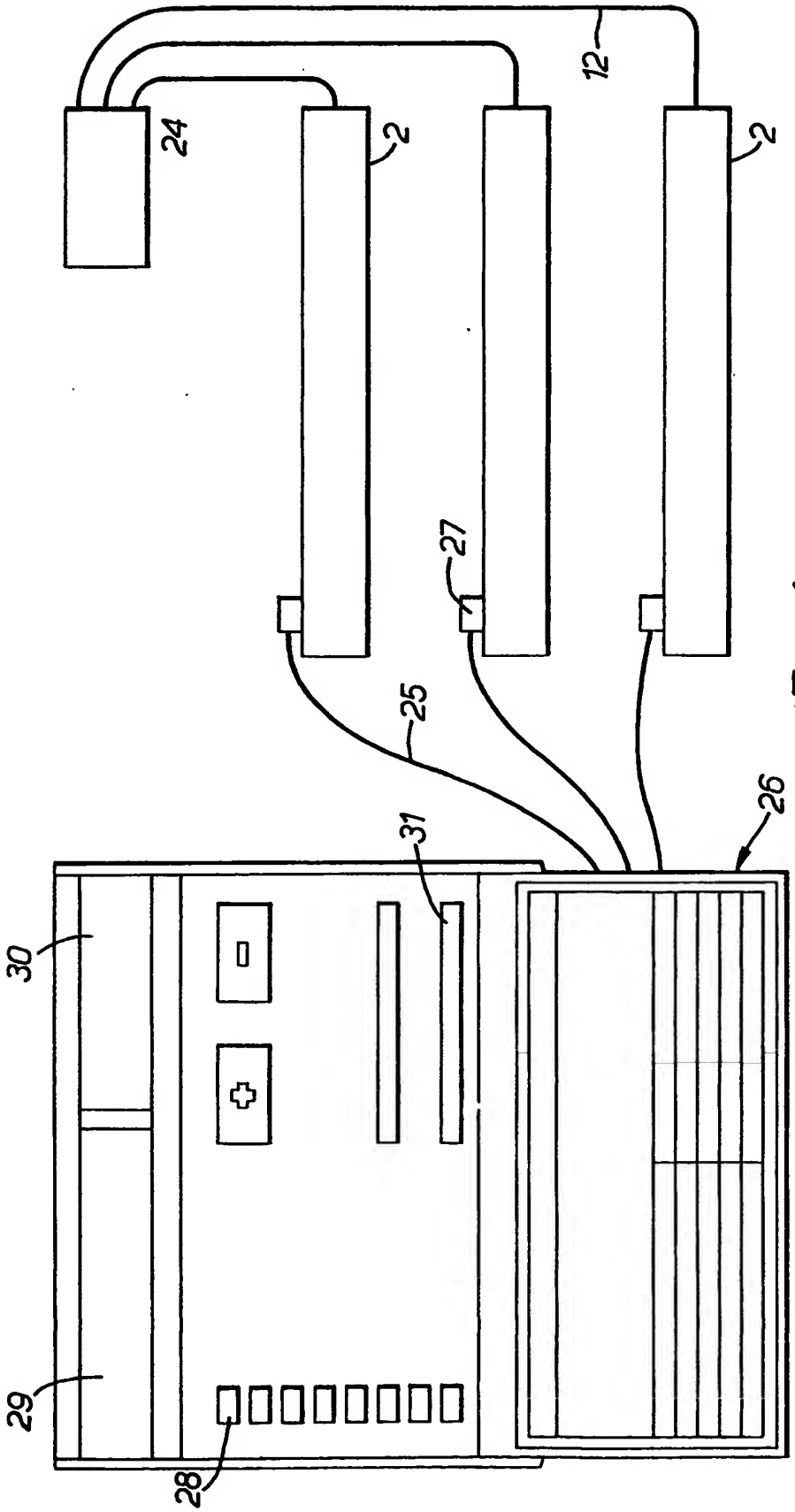

FIG. 4.

SPECIFICATION

Improvements relating to heating systems

This invention is concerned with heating systems, particularly though not exclusively room heating units and heating systems for heating rooms in a building.

The most conventional form of central heating system employs radiators supplied with hot water from a fuel burning boiler. Such a system has low aesthetic appeal and the installation of the various parts required for the system is relatively expensive and time consuming. Furthermore, whilst such central heating systems can be controlled, to the extent that they can be switched on and off when desired, there is an initial heat-up period whilst the water is heated from cold and distributed round the system. Individual radiators in the rooms can only readily be operated individually by either a hand-operated valve or a thermostatically controlled valve. The former requires positive control by the user whereas the latter results in significant additional expense for a complete building.

Another form of heating is a night storage heater which is electrically powered by off-peak energy but this has a warm-up time of several hours and a corresponding cool-down time during the day. Thus such a unit is not capable of supplying a required level of heating at a particular instant and also emits heat when not required

It is an object of this invention to provide heating units which are attractive in appearance and heating systems which are readily controllable whilst being of reasonable expense, both in installation and in operation.

Accordingly, this invention provides, from one aspect. a room heating unit comprising an elongated housing for attachment to the base of a room wall and having a lower air inlet and an upper air outlet, and a heat battery member incorporating an electrical heating element situated in the air path between the inlet and outlet in the housing.

The term "heat battery" as used herein is intended to define a heat storage device which can be raised in temperature rapidly by the electrical heating element and will then emit heat by convection to the ambient air over a longer time scale. Apart from the characteristics of the basic structure of the heat battery, the ratio of the speed of heating input by conduction to heating output by convection will be related to the ratio between the surface area and mass of the heat battery.

The heat battery could be, for example, an oil filled radiator with an internal electrical heating element, although a member in the form of a metallic heat sink is preferred. Indeed in the preferred embodiment the heat sink member is an aluminium block and the heating element is a spiral wound resistance heater within the block. Ideally the heat sink member will be finned to provide an optimum surface area.

The housing for the room heating unit could be designed generally to have the appearance of a skirting board for a room (although necessarily of somewhat greater dimensions in most instances) and thus will be of attractive appearance and will not cover wall space. Also the unit provides floor level heat distribution which is the optimum method of distributing heat throughout a room. The housing can be made in a modular form so that sections thereof can be interlinked (with dummy sections if necessry) to provide a common appearance around the lower surface of the walls of a room.

If the housing inlet is formed at a position spaced upwardly from the base of the housing, then this will reduce the possibility that the unit will draw in dust from the floor surface and creat dirt tracks across a carpet, for example. It is also desirable that the housing outlet should be formed at a position spaced outwardly from the rear of the housing, so as to avoid blowing the heated air, which may possibly be dirt laden, against the wall surface.

It is preferred that the interior walls of the housing at least in the region of the heat sink member should have a reflective surface. This will prevent the outer surface of the casing from become unduly hot to the touch and reduce heat loss into the building wall. It is also of advantage to provide radiant heat absorption plates adjacent to the heat sink member, so as to ensure that most of the heat transfer is carried by convection in the air current passing through the housing. Thus the air will become heated both from contact with the heat sink member and from contact with the heat absorption plates. In most cases the natural convection currents caused through the housing, as the heat sink member is heated, will be sufficient to distribute the heated air but if necessary a fan unit could be provided to assist the passage of air between the housing inlet and outlet and past the heat sink member.

The housing may with advantage incorporate a cableway extending alongs its length and heat-shielded from the heat sink member. This can enclose power and control cables, television aerials, and wiring for various purposes, such as burglar alarm systems. The housing can also usefully include electrical power points for connection to a power supply circuit. Various additional features may be incorporated into the housing such as an air freshener, a smoke detection and warning unit and an air conditioning unit. Plumbing could also be installed in the housing.

The invention also extends to a heating control system comprising a series of independent electrical heat emission units all linked to a microprocessor control unit which is programmable to switch on individual heating units or groups of the total number of heating units in a predetermined sequence during predetermined time intervals.

The combination of electrical heating units distributed, for example, throughout a building with a microprocessor control unit means also that each of the heating units can be individually operated at desired times set into a programme in the microprocessor unit so that absolute control of the time of heating throughout all the rooms in a building can be achieved.

Desirably the heating units are programmed by the microprocessor to switch on and off in a predetermined sequence which may be repeated

during a heating cycle of the system. Thus each heating unit may be switched on for several periods each hour or even each minute which produces more even and controllable heating with optimum economy. This "cascading" effect produces a number of advantages, not least of which is that the power demand on the whole system can be kept at a low level at all times, since only one or a few of the heating units will be powered at any one instant. Thus, for example, three heaters at a time could be supplied with power for a duration of ten seconds, the sequence through all the heating units being repeated continuously during the heating period, or until such time as a desired room or heater temperature is reached, whereupon individual heating units will be cut out by a thermostat or the microprocessor unit. Furthermore, when a heat unit (such as a heat battery) has been brought to a predetermined maximum temperature, the next burst of energy applied to it will occur after a relatively short period of time, so that reheating will be carried out on a heat unit which is already close to its predetermined maximum temperature and in most cases will be more efficient than reheating of a heat unit at a much lower temperture. For example the resistance of aluminium (if used as the heat battery) decreases with increase in temperature. Another advantage is that, with low instantaneous power consumption at all times, only small value power cables need to be used to supply the parts of the system.

Preferably, each heating unit will incorporate a temperature sensor device which will control the switching off of the associated heating unit when a desired temperature has been reached.

It is preferred that the control unit should incorporate a display screen for indicating the state of the system and a clock and a push button keyboard or other information input means. Override control means may be provided to enable individual heaters or groups of heaters to be brought into operation outside the programme determined by the microprocessor. Advantageously, the switching controls for the heaters are connected to the control unit by a secondary low voltage cable. It is preferred that this low voltage cable should be carried where possible, within a housing for the reheating units, and between the housing and the control unit can be mounted by an adhesive, preferably transparent, tape for ease of installation, or be otherwise fixed to or within wall surfaces.

It will be appreciated that the timing of switching on of heating units may be varied to suit particular installations by choosing desired settings when programming or reprogramming the microprocessor unit.

The heating units may take many forms and may for example comprise room heating units of this invention as hereinbefore defined. Alternatively each heating unit could be a foil electrical heating element either in a strip or laid out over a panel.

The invention may be performed in various ways and a preferred embodiment thereof will now be described with reference to the accompanying drawings, in which:-

Figure 1 illustrates a section of a housing for a room heating unit of this invention;

Figure 2 illustrates further features of the housing at the corner of a room;

Figure 3 is a cross-section through the housing of Figure 1 showing features of a heater within the housing; and

Figure 4 is a diagrammatic illustration of the complete heating system using heating units as illustrated in Figures 1 to 3.

The heating unit shown with reference to Figures 1 and 3 comprises an elonated housing 1 enclosing a heater 2. The housing 1 is of fairly shallow depth and is intended for installation in the base of a wall 3 of a room to cover or replace a skirting board. The housing is in two parts which clip together, the rear part 4 being attached to the wall 3 by means of screws, whilst the front part 5 clips over the rear part 4. The two parts 4 and 5 between them define a lower passageway 6 which is divided off from the main interior of the housing by two layers of the material forming the housing to give heat insulation. This passageway 6 can be used to carry cables for various purposes. In the lower front of the housing there is an inlet grille providing a series of elongated openings 7 through which air may enter the housing and a similar outlet grille is formed at the top of the housing by elongated holes 8. The heater 2 comprises an elongated aluminium block 9 having fins 10 or a serrated outer surface so that the block has a substantial surface area. A spirally wound resistance heater element 11 is embedded in the block and is provided with power cables 12. When the heater is switched on its will automatically draw air in through the lower grille 7. As the air passes the fins 10 the air will become heated and will then be driven out through the upper grilled 8 into the room. The lower grilled 7 is situated some distance above the floor surface so as to reduce the tendency for dirt tracks to be formed over the surface of a carpet 13 as air is drawn into the housing 1.

A typical heater will be approximately 1.2 m long and will have a 1kw power input with the finned surface area providing a surface of approximately 4,500cm^2. In order to reduce heat losses into the wall 4 and also so as to prevent the outer face of the front part 5 of the housing from becoming uncomfortably hot, the inner wall surface of the housing parts 4 and 5 will be silvered so as to reflect heat back into the interior of the housing to heat air passing therethrough. Furthermore a certain amount of heat will be radiated from the heater 2. In order to ensure that a majority of this radiant heat is absorbed by the air passing through the housing, heat absorption plates 2A are provided on both sides of the heater 2. These will be formed from a black material which will readily absorb radiant heat and this will be passed onto the air passing through the housing.

Sections of the housing may be formed for special additional purposes. Thus, for example, as shown in Figure 1 a section 14 is provided which carries control switch 15 enabling an adjacent heater to be switched to an on or off condition or for enabling an external control to be overriden.

Figure 2 illustrates how sections of the housing may be interlinked by a corner section 16. Also

power points 17 can be incorporated into the housing for receipt of electrical plugs 18. A further section 19 has a removable panel 20 providing connecting points 21 for the connection of cables from a stereo system and a point 22 to which may be connected a television aerial lead 23. The passageway 6 at the base of the housing can carry cables for all kinds of purposes, such as for burglar alarm systems. Further sections of the housing may incorporate, for example, units for smoke detection and for air conditioning as an alternative to space heating. An air freshener in the form of a biodegradeable filter of carbon cloth could be incorporated in the air flow passageway in the housing,

A complete heating system for a building, as generally illustrated in Figure 4, will comprise a number of heaters 2 (within their respective housings) having a power supply from the fuse box 24 of a mains supply and being controlled via control lines 25 from a control unit 26. Each line 25 will run to a switch unit 27 associated with its respective heater 2. This will incorporate an on/off control and a thermostat for switching off the heater 2 when a particular temperature has been reached. The control unit 26 incorporates a number of control buttons 28 by means of which information may be incorporated into a microprocessor of the control unit. A display portion 29 will indicate details of information being inserted into the microprocessor or information stored in the microprocessor. There is also a digital clock 30 which indicates real time. The cables 25 are suitably screened to eliminate spurious pulses and since they only carry 9 volts they can therefore be led to the switching devices 27 over external wall surfaces and then into and along the interior of the housing 1.

When information relating to the control of the individual heaters 2 has been incorporated into the microprocessor the switching on and off of the individual heaters 2 will be carried out automatically. It is envisaged that each heater can take between five and ten minutes to heat up from ambient temperature and then have a cool down time of about twenty minutes. The heaters (or individual groups of heaters) will be switched on repeatedly in sequence for short periods of time (say 10 seconds) so that the overall loading on the power system at any moment is relatively small and small power cables 12 can be employed. Thus each heater will be subjected to several heat cycles per hour (for example approximately once every two minutes or so depending on the number of heaters in the system) which will result in more even heating of each room. Of course the different heating requirements of individual rooms or sections of the building can readily be met by keying into the control unit 26 the relevant control information.

It is envisaged that each heating unit will incorporate a switching device such as a triac which will control the bursts of power to the heating unit during the heating cycle. Ideally the triac will be switched at zero current which has the advantages that it prevents stray electromagnetic radiation from the switching interfering with domestic devices such as televisions and it reduces the switching power consumption. The triacs will also be controlled by an override switch 31 on the control unit 21. When the switch 31 is operated lights 32 (Figure 1) will come on to show that the override is operative and then a limited number of heating units can be switched on (by the switches 15) to provide localised rapid heating of rooms if required. The control unit will incorporate a trip switch to prevent overloading of the system if the consumer tries to switch on too many heating units.

Additional fetures which can be incorporated into the control unit 26 are a switch, which will switch on the heating system at times other than those recorded in the memory, and possibly means for displaying information concerning overall power consumption over a period of time to enable the user to determine the cost to data of operating the heating system.

CLAIMS

1. A room heating unit comprisng an elongated housing for attachment to the base of a room wall and having a lower air inlet and an upper air outlet, and a heat battery member incorporating an electrical heating element situated in the air path between the inlet and outlet in the housing.

2. A room heating unit according to claim 1, wherein the heat sink member is an aluminium block and the heating element is a spiral wound resistance heater within the block.

3. A room heating unit according to claim 1 or claim 2, wherein the heat sink member is finned to provide an optimum surface area.

4. A room heating unit according to any one of claims 1 to 3, wherein the housing inlet is formed at a position spaced upwardly from the base of the housing.

5. A room heating unit according to any one of claims 1 to 4, wherein the housing outlet is formed at a position spaced outwardly from the rear of the housing.

6. A room heating unit according to any one of claims 1 to 5, wherein the interior walls of the housing at least in the region of the heat sink member have a reflective surface.

7. A room heating unit according to any one of claims 1 to 6, wherein radiant heat absorption plates are positioned adjacent to the heat sink member.

8. A room heating unit according to any one of claims 1 to 7, including a fan unit to assist the passage of air betwen the housing inlet and outlet and past the heat sink member.

9. A room heating unit according to any one of claims 1 to 8, wherein the housing incorporates a cableway extending along its length and heat-shielded from the heat sink member.

10. A room heating unit according to any one of claims 1 to 9, wherein the housing includes electrical power points for connection to a power supply circuit.

11. A room heating unit according to any one of claims 1 to 10, wherein the housing includes an air freshener unit, and/or a smoke detection and warning unit, and/or an air conditioning unit.

12. A room heating unit substantially as herein described with reference to the accompanying drawings.

13. A heating control system comprising a series of independent electrical heat emission units all linked to a microprocessor control unit which is programmable to switch on the heating units or groups of the total number of heating units in a predetermined sequence during predetermined time intervals.

14. A heating control system according to claim 13, wherein each heating unit incorporates a temperature sensor controlling a device operable to switch off the associated heating unit when a desired temperature has been reached.

15. A heating control system according to claim 13 or claim 14, wherein the heating units are programmed by the microprocessor to switch on and off in a predetermined sequence which may be repeated during a heating cycle of the system.

16. A heating control system according to any one of claims 13 to 15, wherein the control unit incorporates a display screen for indicating the state of the system and a clock and a push button keyboard or other information input means.

17. A heating control system according to any one of claims 13 to 16, wherein override control means is provided to enable individual heaters or groups or heaters to be brought into operation outside the programme determined by the microprocessor.

18. A heating control system according to any one of claims 13 to 17, wherein the switching controls for the heaters are connected to the control unit by a secondary low voltage cable.

19. A heating control system according to claim 18, wherein the low voltage cable is carried by an adhesive, preferably transparent, tape.

20. A heating control system according to any one of claims 13 to 19, wherein the heating units are of the form as defined in any one of claims 1 to 12.

21. A heating control system according to any one of claims 13 to 19, wherein each heating unit is a foil electrical heating element in a strip or laid out over a panel.

22. A heating control system substantially as herein described with reference to the accompanying drawings.

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